(11) (C) (CA) No. 935606

(45) ISSUED Oct. 23, 1973

(52) CLASS 14-6
C.R. CL.

(10) CANADIAN PATENT

(54) HYDRAULIC DOCK LEVELLER

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Granted to Blue Giant Equipment of Canada Limited, Brampton, Ontario, Canada

(21) APPLICATION No. 104,695
(22) FILED Feb. 8, 1971

(30) PRIORITY DATE

No. OF CLAIMS 7

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CCA-274

Field of the Invention

This invention relates to dock levellers of the type having a ramp hinged to the dock at one end and a lip member hinged at the other or forward end of the ramp.

Prior Art

In Canadian Patent 816,596 a dock leveller of the type mentioned above is described, mechanical elevating means are provided to raise the ramp member about its hinge and lip lifting means responsive to said mechanical elevating means are also provided to raise and lock the lip as the ramp is raised to a predetermined position so that when the ramp is lowered by application of a load the lip can be brought to rest on the platform of a truck.

The mechanical elevating means for the ramp involves a multiplicity of upwardly biasing springs located on the underside of the ramp; a braking mechanism is employed to hold the ramp downwards against the springs. While in practice the arrangement has proved to be most effective and durable, it is nevertheless bulky.

Hydraulic elevating means for the ramp would appear to offer a simpler solution but in the past such means have been expensive to install, maintenance costs have been relatively high and difficulty has been experienced in providing proper controls in raising and lowering the ramp.

Summary of the Invention

Accordingly, it is an object of the invention to provide a dock leveller having a ramp hinged at one end to the dock with a lip member hinged at the other or forward end of the ramp with hydraulically actuated means and controls therefore to raise, lower and permit floating of the ramp and lifting means

for the lip responsive to said hydraulic elevating means. Further the invention provides for auxiliary lip controls for handling below dock level trucks loaded right to the rear and unable to accept the hinged lip. The invention further provides safety arrangements to prevent sharp drops of the ramp which could tip vehicles or other loads on the ramp.

Brief Description of the Drawings

The invention will now be described in relation to the accompanying drawings, in which:

Figure 1 is a perspective front view of a hydraulically operated dock leveller of this invention, the ramp being shown in the raised position;

Figure 2 is a diagram showing the control system for the hydraulic ramp elevating means;

Figure 3 is a perspective view of the disposition of the safety stops provided in the dock leveller;

Figure 4 is a diagrammatic view of the position of the pendent lip when the ramp is substantially horizontal;

Figures 5, 6 and 7 illustrate the position of the pendent lip at the safety stop levels, the ramp being inclined downwardly;

Figure 8 illustrates the auxiliary lifting mechanism.

Figure 9 is a side view showing the connection of the hydraulically operated piston to the ramp;

Figures 10, 11 and 12 are side sectional views of a dock leveller in accordance with the invention and serve to illustrate the mechanism for controlling the attitude of the lip in accordance with the present invention.

Description of the Preferred Embodiment

Referring now to the drawings in Figure 1 there is

illustrated a general front perspective view of a dock leveller in accordance with the present invention. In this illustration a ramp member 16 is displayed in an inclined attitude but it will be understood that normally when not in use the ramp 16 will be substantially flush with the surface of a dock, not shown, in which it is mounted, that is in the position illustrated in Figure 4.

It will be observed that a lip 18 is hingedly secured to the forward edge 28 of the ramp member 16.

As illustrated in Figure 1, the dock leveller generally comprises a ramp member 16, which is hingedly mounted adjacent its rear end to a supporting frame, generally indicated at 22. The ramp 16 comprises a rigid frame having side members 24 and 26 with forward and rear members 28 and 30. On the frame a rigid sheet 32 is secured and on the underside transverse and longitudinal reinforcing members 34 are supplied as necessary. Hingedly secured to the side members 24 and 26 are downwardly and inwardly disposed angular sheet members 36 and 38 which act as guards in the event that the operator may inadvertently place his foot under the ramp 16.

The supporting frame 22 comprises assembled angle irons 40, 42, 44 and 46. To the rear angle iron 46 vertically extending corner members 56 and 60 are secured; and in between is a channel 58 which houses the power pack; gussets 62 and 64 are provided to give added rigidity to the members 56 and 60. The upper ends of members 56, 58 and 60 are connected together by a horizontally extending member 63 to which the end member 30 of the ramp 16 is hinged in conventional manner. The frame 22 has a cross member 66 secured to the angle irons 40 and 42. Stiffening members 68 and 70 connect the cross

member 66 to the vertically extending members 56 and 60.

The member 66 has a pair of spaced apart lugs 72 and 74; a pin 76 bridges the lugs 72 and 74. The pin 76 pivotally secures one end of a cylinder 78 from which extends an hydraulically operated piston 80 which is pivotably secured at its other end to a lug 29 carried by the ramp frame member 28, see Figure 9. It will be obvious that outward movement of the piston 80 from the cylinder 78 will elevate the front end 28 of the ramp 16. A cable 82 secured to the lug 72 and the end member 28 limits the upward movement of the ramp 16.

The control system for the hydraulic operation of the piston rod 80 is illustrated in Figure 2. A motor 84 actuated by depression of a switch 86 drives a pump 88 and fluid is delivered through a pressure relief valve 90 to the cylinder 78 with the result that the piston 80 is extended and the ramp 16 moves upwardly. The pressure relief valve 90 is set at a predetermined pressure and in the event that the pressure in the fluid line to the cylinder 78 exceeds this pressure, for example when the ramp is fully raised and cable 82 is tensioned and the pump 88 continues to run, fluid will be by-passed through the pressure relief valve 90 into the reservoir.

To lower the ramp 16 a solenoid valve 92 is located in the hydraulic line and this is operated by depression of a switch 94 with the result that fluid flows from the cylinder 78 through the solenoid valve 92 back into the reservoir and the piston 80 will move down into the cylinder 78 under the weight of the ramp 16, thus effecting lowering of the ramp.

To the forward edge of the ramp 16 a lip 18 is hingedly secured. A plurality of spaced apart tubes 96 are provided on the forward edge of the ramp 16 and on the rear

edge of the lip 18 corresponding spaced apart tubes 98 are secured which mate with the spaces between the tubes 96. These two series of tubes are secured in engagement by means of a rod 100 extending therethrough.

As illustrated in Figures 10, 11 and 12, a lug 102 is secured to the tube section 98 of the lip member 18. Lug 102 is, in turn, hingedly secured by a pin 104 to an arm 106 adjacent the forward end thereof. Arm 106 extends through an opening 108 in the front wall 28 of the ramp member 16. To arm 106 a lever 110 is hingedly secured by means of a pin 112 in the manner illustrated. Lever 110, is, in turn, hingedly secured intermediate its length by a pin 114 to a bracket 116 rigidly secured to the underside of ramp member 16. The lower extremity of lever 110 is secured by means of a pair of cables 118 to the cross member 66.

To the underside of ramp member 16 rearward of the bracket 116 a transversely extending bar 120 is rigidly secured. Rearward of the bar 120 a pair of spaced apart brackets 122 are secured to the underside of the ramp 16. To brackets 122 a cylinder 124 is hingedly secured by means of a pin 126; within the cylinder 124 a spring 128 is disposed to engage a piston 130 having a rod 132 rigidly secured thereto and extending outwards of the forward end of the cylinder 124. Adjacent the rear end of the cylinder 124 and bearing against the spring 128 is another piston 134 which is adjustably mounted by means of a threaded rod 136 which extends outwards of the cylinder 124, adjustment being made by means of a nut 138. The end of the rod 136 is connected by means of a cable 140 and a spring 142 to the cross member 66.

When the ramp 16 is in the horizontal position the lip

18 depends downwardly, see Figure 12, but as the ramp 16 rises through the action of the hydraulically operated piston 80 the cables 118 begin to exert a pull on the lever 110 and as a result the arm 106 moves forward urging the lug 102 to turn the lip 16 in an upward direction. At the same time the spring 142 is being extended and the cable 140 secured thereto causes the forward end of the cylinder 124 to move about its hinge pin 126 in an upward direction. The arrangement is such that the end of the rod 132 eventually engages the rear surface of the arm 106 when the ramp 16 has been raised sufficiently and the lip member is then held in the attitude illustrated in Figure 10. Preferably the end of the rod 132 is slightly bevelled to facilitate engagement and disengagement with the end of the arm 106.

When a vehicle approaches the dock the ramp 16 is raised by means of the hydraulically operated piston 80 to the position shown in Figure 10, after which the ramp 16 is lowered until the lip 18 contacts the rear platform of the vehicle. As the vehicle takes the weight of the lip, the arm 106 will be pulled forward and the engagement between rod 132 and lever 106 will be broken and because cable 140 is now slack the cylinder 124 will drop . At this point the relationship between the various components will be as illustrated in Figure 11 and when the truck is withdrawn the lip 18 will then drop to the position of Figure 12.

On lowering the ramp 16 the leading edge of the pendent lip 18 enters behind the end member 44 of the supporting frame 22; contact between the edge of the lip 18 and the base of the end member 44 terminates further downward movement of the ramp 16, see Figure 4.

To provide for further lowering of the ramp 16 in order to facilitate loading or unloading of trucks having load levels below the horizontal level of the ramp 16 and loaded to the back with no room to accommodate the lip, an auxiliary lip lifting mechanism, generally denoted by the numeral 143, is employed, which mechanism is illustrated in Figure 8. It comprises a lever arm 144 of angular configuration having a first portion 146 which extends through an aperture 148 located in the end member 28 of the dock leveller which first portion 146 extends upwardly therefrom towards the lip 18. Integrally connected to the first portion 146 of the arm 144 is a second portion 148 which extends rearward of the end member 28 of the dock leveller. The arm 144 is pivoted as at 150 located at the junction of the first and second portions. The free end of the first portion 146 is provided with a roller 152.

One end of a roller chain 154 is secured to the inwardly directed portion 148 with the chain 154 extending upwards through the ramp 16 to terminate in a handle 156 shaped as shown in Figure 8 resting in a well 158 in the ramp surface 16.

To operate the auxiliary mechanism it is first necessary to operate the hydraulic piston 80 by depression of the switch 86 so that the ramp 16 is raised sufficiently for the forward edge of the lip 18 to clear the front end member 44 of the frame 22. Then the operator simply raises the handle 156 and the pivotal movement of the arm 144 causes the lip 18 to swing outwards. Then the ramp 16 is lowered downwards by depressing the switch 94.

The ramp may be conveniently lowered to its bottoming position as illustrated in Figure 7 where plates 164 provided on the underside of the ramp contact frame member 44.

The frame member 44 is also provided with safety stops 160 and 162 which present ledges into which the lower edge of the lip 18 can drop when the lip does not have the opportunity to fall behind the frame member 44 into the position illustrated in Figure 4 as explained below.

Normally when the ramp is raised above the horizontal to any appreciable extent and the truck drives away the lip due to its eccentric pivot swings downwardly and inwardly into a position to enter behind the frame member 44 as the ramp is lowered. However if the ramp is near the horizontal it may not be able to clear the frame member 44 and as the ramp is lowered will enter one of the ledges in the safety stops 160 and 162 with slight downward movement. In any of these circumstances the ramp will be positively supported so that it will not drop sharply in the event for example, a vehicle is driven onto the ramp when the ramp appears to be, but is not in proper cross traffic position.

Also the safety stops may be used to locate the ramp slightly below horizontal when using the auxiliary lip control mechanism 142, if desired.

The hydraulic system of the dock leveller according to the invention also incorporates a safety feature to prevent dropping of the ramp when a truck drives away leaving a load such as a vehicle on the ramp. In this connection, there is provided a velocity fuse 166 which is preferably located in the base of the cylinder 78. This velocity fuse may for example be of the type manufactured by Waterman Hydraulics Corporation of

Evanston, Illinois, and is adapted to cut off discharge from the piston 78 in the event the velocity flow exceeds a predetermined rate. Thus the sudden rise in pressure in the hydraulic system by the inadvertent driving away of the truck which would otherwise force oil at a high rate through the pressure relief valve, is translated into a locking of the oil in the piston precluding further downward movement of the ramp.

It will be understood that as a truck is unloaded the truck springs will elevate the truck body and will cause a force on the underside of the lip 18 when the relationship of Figure 11 obtains. This force in turn will apply an upward force to lift the ramp thereby withdrawing the piston 80 from the cylinder 78. In order to allow the ramp to float upwardly with the truck body a check valve 168 is provided to allow oil flow from the reservoir into the cylinder 78 as the piston is withdrawn. By the use of this check valve the need for any extensible connection between the ramp and piston rod is eliminated and the hydraulic unit may be connected directly between the ramp and its supporting frame since it forms in effect an expansible system.

In accordance with the invention there is thus provided a very economical versatile dock leveller with complete safety provisions.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A dock leveller having a hinged ramp member, a lip member hinged to said ramp, hydraulic means for raising and lowering said ramp and means for raising said lip, said hydraulic means including a hydraulic cylinder connected to said ramp member, means for delivering hydraulic fluid under pressure to said cylinder to raise said ramp and one way means for delivering hydraulic fluid to said cylinder in response to an upward pressure on said ramp applied externally of said system to allow said ramp to float upwardly under pressure from a rising truck body as the truck is unloaded.

2. A dock leveller as claimed in Claim 1 in which means are provided to lock said lip in a raised position as the ramp is lowered until the weight of the lip is taken up by an external force as by the lip coming to rest on the body of a truck.

3. A dock leveller as claimed in Claim 1 in which said hydraulic means includes means to limit upward force on the ramp.

4. A dock leveller as claimed in Claim 3 in which means are provided to lock said hydraulic means against sudden downward ramp movement.

5. A dock leveller as claimed in Claim 1 in which a check valve is provided to allow fluid flow into said cylinder under upward pressure on said ramp.

6. A dock leveller as claimed in Claim 1 having auxiliary lip lifting means.

7. A dock leveller as claimed in Claim 1 in which means are provided to intercept said lip when in a dependent position at different heights to lock said ramp in selected positions commencing with said ramp at a first horizontal position and terminating with said ramp at a position below horizontal.

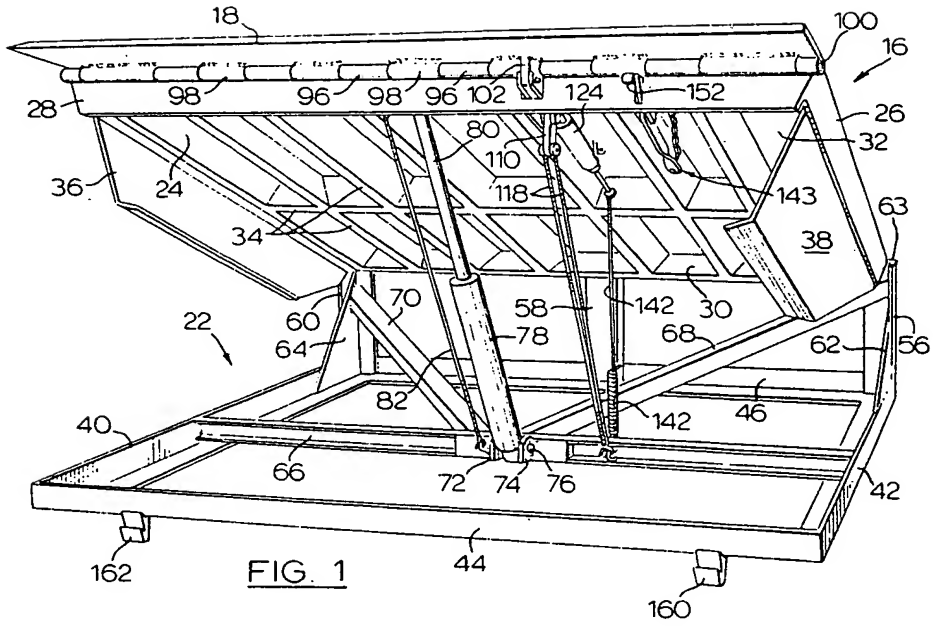
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FIG. 1

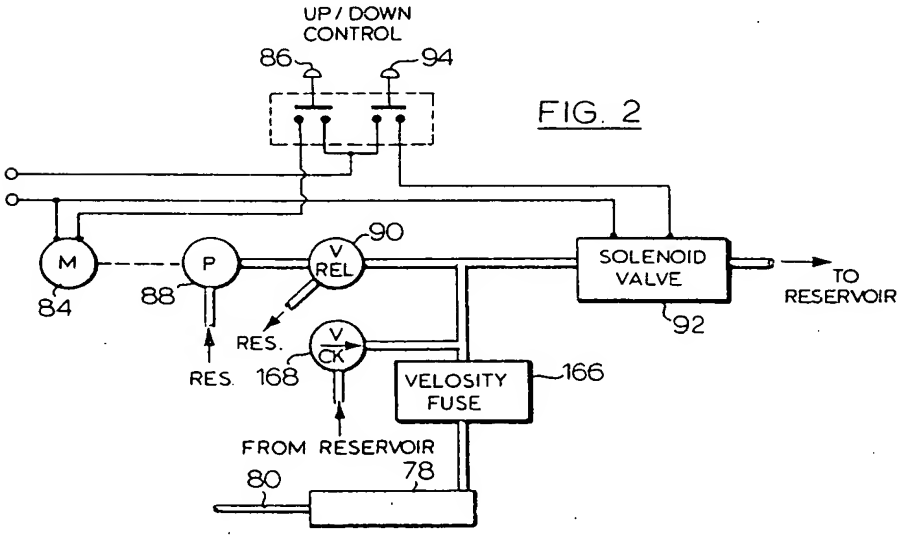
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FIG. 2

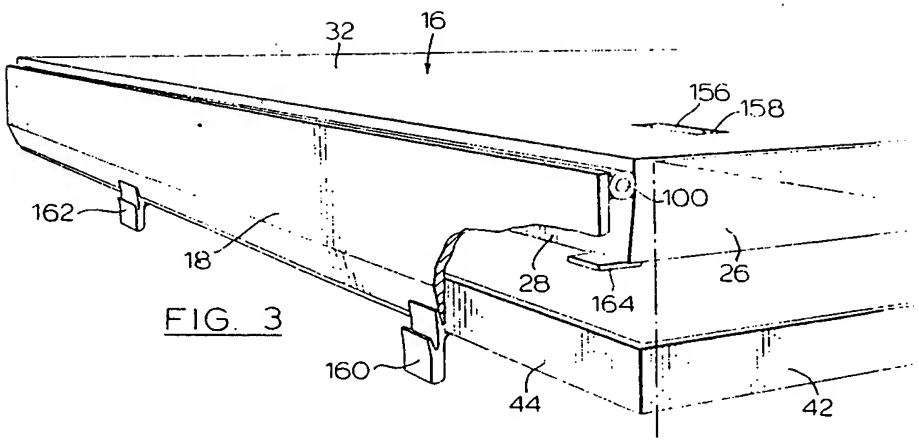

FIG. 3

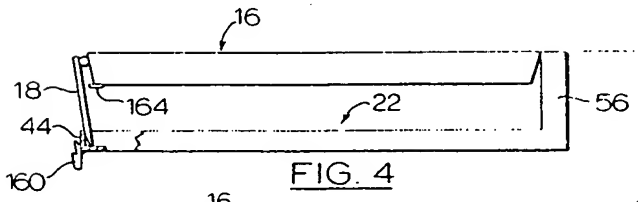

FIG. 4

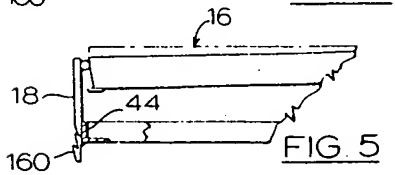

FIG. 5

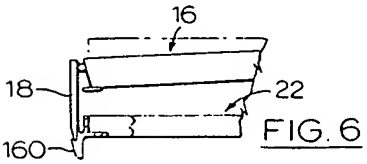

FIG. 6

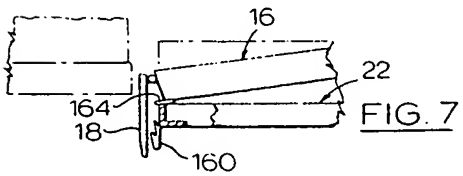

FIG. 7

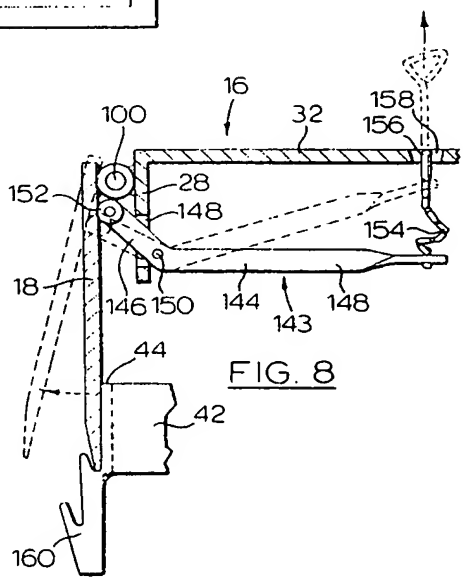

FIG. 8

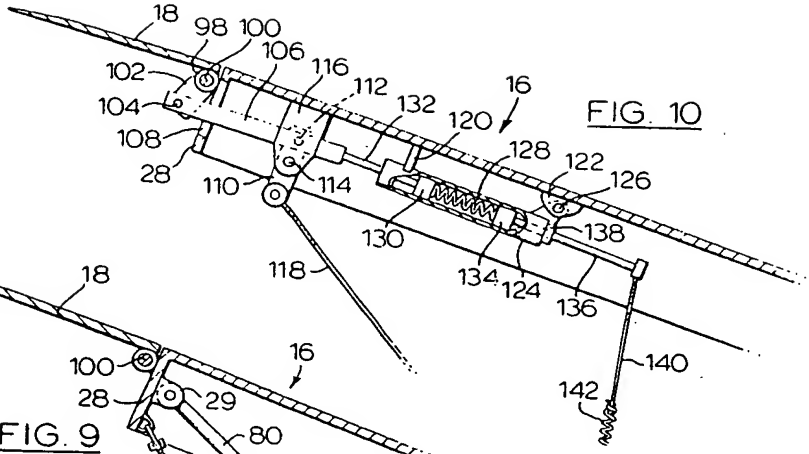

FIG. 10

FIG. 9

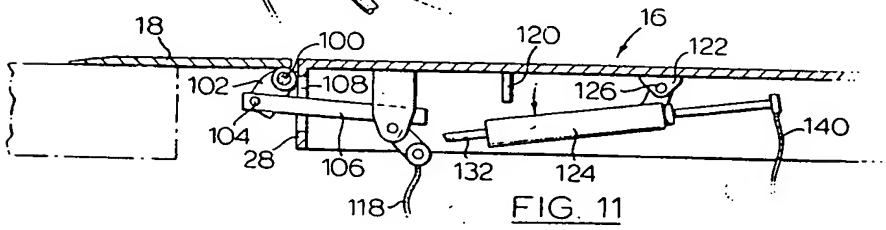

FIG. 11

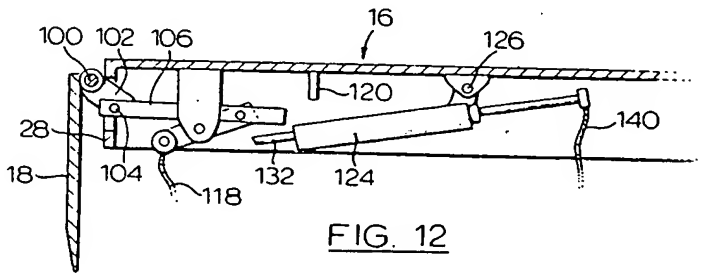

FIG. 12